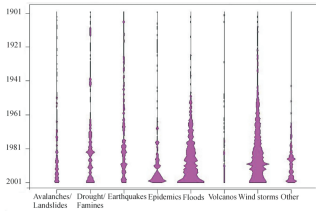


METEOROLOGICAL AND HYDROLOGICAL EVENTS. IMPACT ON SOCIETY AND ENVIRONMENT IN ROMANIA

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Lately, even more regions in Europe were hit by rather violent natural phenomena causing numerous casualties and material losses (fig. 1).

Fig. 1 NUMBER OF NATURAL DISASTERS REPORTED (EM-DAT: The OFDA/CRED International Disaster Data base - <http://www.cred.be>)

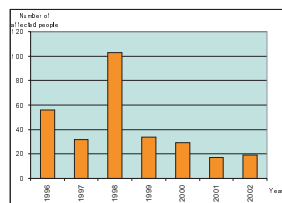


Brief overview of climate particularities in Romania

In view of its global location, Romania is situated in the *temperate climate zone*, while its position on the south-eastern part of the Continent assigns it to a *temperate-continental zone*.

The genetic particularities of the climate in Romania as shaped by the specific relationships between radiation, general atmospheric and the active surface, with highlight on the barrage role of the Carpathian Mountains. The mountainous chain of the Carpathians delimits several sectors, subjected to external climatic influences as follows: west (Oceanic), south-west (Submediterranean), east (Continental), transitional from Oceanic and Submediterranean to Continental in the central-southern part, Baltic in the north-west part and Pontic along the Black Sea coast (source: *Romania. Environment and Electricity Transmission Grid. Geographical Atlas*, 2002).

Fig. 2 Natural Disaster Profile of Romania (1996-2002) (EM-DAT: The OFDA/CRED International Disaster Database)



CRED International Disaster Database (*Centre for Research on the Epidemiology for Disasters*, Université Catholique de Louvain, Belgium) includes a number of 24 natural disasters that affected Romania during 1996-2002; their selection was based on some criteria among which at least one has to be fulfilled (fig. 2):

- 10 or more people reported killed;
- 100 people reported affected;
- a call for international assistance;
- declaration of a state of emergency.

In Romania various natural phenomena (*most frequently floods and droughts*) have a negative impact on the environment, on society and the economic sector (especially agriculture) producing damages or casualties. The particularities of the geographical factors (among which the alternation of rainy and droughty periods), generate major spring and early summer floods.

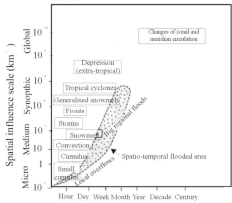
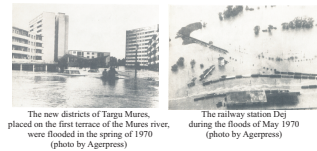


Fig. 4 Space-time scale of flood-inducing climatic and hydrologic phenomena (after Hirschboeck, 1988)



The year 2000 was considered by the WMO to be the 22nd consecutive year in which the global average air temperatures were higher than the normal record over the 1961-1990 period, and the 7th hot year during the past 140 years, despite the intervals of cold induced by the La Nina phenomenon (*WMO Bulletin*, 50, 3, July 2001). The heat waves registered during July and August in several South-East European states, with over 43 C degrees in Greece, Italy, Turkey and even Romania, caused many casualties and much damage, particularly in agriculture.

The severe drought that struck Romania during 1992-2002 (particularly in the years 1992-1994), resembled that of 1946 (assumed to be the droughtiest year), but was far worse than it, because it was associated with extreme heat (40-43 C degrees) and low quantities of rain compared to the normal June-August record. The peak events occurred in 2000-2002 and entailed negative economic and social effects (destroying crops, diminishing water reserves etc.) (Pleniceanu, Golea, 2003).

The drought of 2000, one of the most severe ever affecting Romania (in its southern and south-eastern parts) also covered large areas in Central and Eastern Europe; according to some authors "Romania suffered the most" (Glina et al., 2001), with disastrous economic consequences, particularly in agriculture: 95% of the maize crop and all vegetable production (soya and bean) were lost. The lowering of the watertable and the severe decrease of ground resources and of storage-lake levels, with wells and several rivers going dry, had negative effects on the population's water supply, some water power stations being closed down, the big Iron Gate Power Plant being operated at low capacity (Pleniceanu, Golea, 2003). In view of it, the Government decided to supplement investments in 2001 for the rehabilitation of existing irrigation systems in order to reduce the detrimental economic and environmental effects of the year 2000.



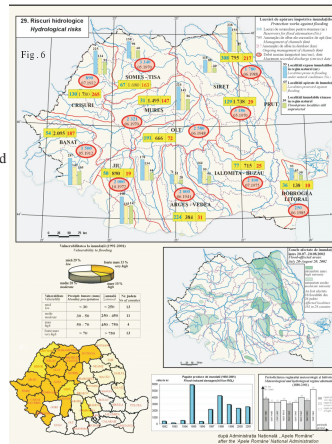
Low levels - Romanian Lower Danube Sector (photos by Cheval, S., 02/09/2003)

Flooding is the cause of landscape changes over varied time-intervals, depending on the climatic and hydrological phenomena unleashing them. Most spectacular and lasting overflows in terms of volume and damage are usually triggered by cyclones. Others, of shorter duration, lasting hours or days, are produced by cumulus clouds and convection processes (Romanescu, 2003) (fig. 4).

The number of *catastrophic floods* kept rising from 28 in the 19th century to 42 in the 20th (particularly in the year 1970), largely due to the global and local climate change (air temperature increase, short heavy rainfall over small areas etc.) and the human impact (deforestations, effects of pollution induced by urban agglomerations and industrial activities etc.) (see photos and fig. 5). The floods of 1970 and 1975 were the costliest ever experienced by Romania, approximately \$ 500, 000 (1970). The flood-induced damages over 1992-2001 period were estimated at 25, 000 billion ROL as more than 2, 000 localities were affected; July-August 2002 - about 180 settlements from 28 counties, numerous roads, bridges, railways, etc. (after "Apele Române" National Administration reports) (fig. 6).



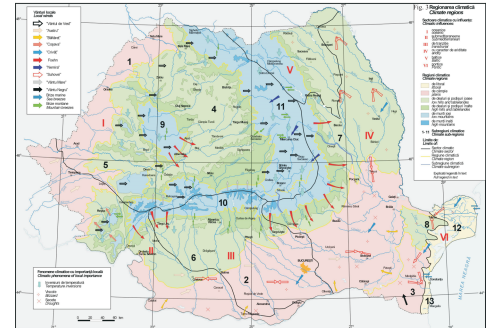
Fig. 5 Areas affected by floods after the heavy rains of 1-4 July 1975, and the precipitation amounts (Zavoiana, 1977; in Dragota, 1999)



(source: Romania. Environment and Electricity Transmission Grid, Geographical Atlas, 2002)

The drought of 2003 is also having negative effects :

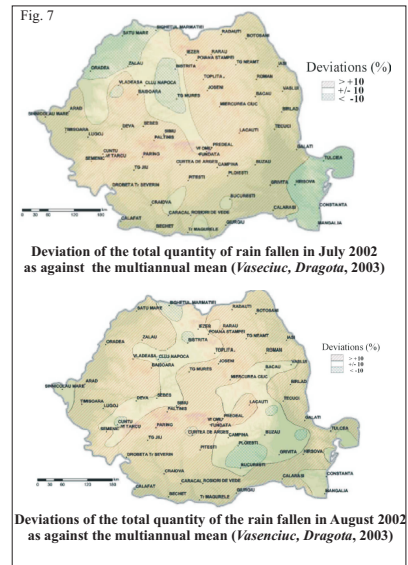
- the lowest Danube levels in the Delta sector over the past 50 years (according to hydrological forecasts on March 24th, 2003);
- in the last decade of August 2003, the Danube levels at the river's entrance on Romanian territory (Bazias) fell from 1,750 cum/s to 1,600 cum/s compared to the normal value of 5,500 cum/s and 4,770 cum/s foreshadowed for a droughty year, being the lowest record over the last 160 years (Adevarul Newspaper, 27/08/2003) (see photos);
- Danube levels decreased at -1.17 m;
- limited and controlled navigation in the critical sectors of the river (according to the Romanian Naval Authority and the Fluvial Administration of the Lower Danube);
- lower discharge on several Romanian rivers, down to damage levels;
- problems of drinking-water supply to the population in some regions, rationalization of water consumption, restrictive measures on water resources required by irrigation, industrial estates and households;
- difficulties in securing the water requirement for some industries and measures to recycle used water;
- the functioning of the Cernavoda Nuclear-Electric Central Reactor No. 1 was discontinued for a period of 4-6 weeks starting from the end of August (an unprecedented situation in the seven years of its operation);
- wild fires broke out through self-ignition of dry vegetation due to prolonged drought and high temperatures (15 ha of pasture and forest-land in the counties of Brasov and Harghita burnt down)(Adevarul Newspaper, 30/08/2003);
- national energy crisis entailing monthly losses of \$ 100 million. The Government had to import energy, thermal power stations had to work at full capacity (from 49% before 1989 to 85% in 2003), energy exports were halted (given that the electricity demand in 2003 has been 10% higher than in 2002);
- better wine quality but lower productions;
- more medical emergencies (especially in heart and lung affections).



(source: Romania. Environment and Electricity Transmission Grid, Geographical Atlas, 2002)

The summer of 2002 brought high floods in some Central European countries. At continental scale losses amounted to at least 15 billion Euro (*Munich re, Geo Risks Research Dept., CUG3-GEO-17/12/2002*).

The 2002 record in Romania suggested a "whimsical" year, with positive and negative quantitative annual deviations, significant in terms of value, from the multiannual means. Monthly deficits of precipitation were registered only in a few NW, Central and SE areas, elsewhere they were normal and even in excess over large areas (more than 200 mm in NE, 80-90 mm in the S and over 30-40 mm in SW) with high values versus the monthly multiannual mean (Vasenciuc, Dragota, 2003) (fig. 7).



Deviations of the total quantity of the rain fallen in August 2002 as against the multiannual mean (Vasenciuc, Dragota, 2003)

A peculiar phenomenon, never before signalled in Romania, occurred in the south-eastern part of the country (Ialomita County) on the evening of 12.08.2002. It developed over Faceni commune and had dramatic effects. The Bucharest Doppler Radar data from that day and the scientific investigations made specialists assume that the phenomenon was indeed a *tornado*. The damages rose to almost 2,000,000 Euro (source: Civil Protection reports) and included:

- about 1km² of built-in area (428 dwelling-houses impaired and 33 completely destroyed);
- 2 casualties;
- 14 wounded;
- forest area destroyed (~ 120 ha);
- electrical network damaged (about 50 billion ROL);
- locally damaged telecommunication network.



Tornado effects still visible even after a month from its occurrence (photos by Cheval, S., 27/09/2002)